IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Song
Serial No.:	10/770,893
Filed:	February 3, 2004
Group Art Unit:	1742
Examiner:	Morillo, Janell Combs
Title:	CASTABLE HIGH TEMPERATURE ALUMINUM ALLOY

M/S AF
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

APPEAL BRIEF

Dear Sir:

Appellant now submits this Appeal Brief subsequent to the filing of the Notice of Appeal on December 10, 2007. Fees in the amount of $500.00 may be charged to Deposit Account Number 21-0279 in the name of United Technologies Corporation. Applicant believes that no additional fees are necessary; however, the Commissioner is authorized to charge the same Deposit Account for any additional fees or credit the account for any overpayment.

Real Party in Interest

The real party in interest is United Technologies Corporation, assignee of the present invention.

Related Appeals and Interferences

Co-owned application 11/231,479 entitled "METHOD OF PRODUCING A CASTIBLE HIGH TEMPERATURE ALUMINUM ALLOY BY CONTROLLED SOLIDIFICATION" is currently under appeal.

Status of Claims

Claims 17-25 were previously cancelled. Claims 1-16 and 26-29 stand rejected and are appealed.

Status of Amendments

All amendments have been entered.

Summary of Claimed Subject Matter

The application generally relates to an alloy for use in high temperature environments. The alloy retains strength at elevated temperatures and can be produced using conventional types of casting techniques.

The application includes four independent claims (claims 1, 6, 9, and 10), which are summarized as follows.

Independent claim 1 is directed to an aluminum alloy composition including 1.0wt% to 20.0wt% of a first rare earth element selected from a group consisting of ytterbium and gadolinium [see Specification page 4, paragraph 21, lines 1-5; page 6, paragraph 30, lines 1-3], a plurality of insoluble particles formed of the first rare earth element [page 4-5, paragraph 22, lines 5-12; page 8, paragraph 36, lines 1-6], and approximately 0.1wt% to 10.0wt% of at least one second rare earth element selected from the group consisting of gadolinium, erbium, and yttrium if the first rare earth element is ytterbium [page 4, paragraph 22, lines 1-5] or the group consisting of ytterbium, erbium, and yttrium if the first rare earth element is gadolinium [page 7, paragraph 32, lines 1-6]. The combined weight of the first rare earth element and the at least one second rare earth element is greater than 10.0wt% [page 5, paragraph 23, lines 1-3; page 7, paragraph 33, lines 1-3]. The aluminum alloy composition also includes at least one minor alloy element comprising copper, zinc, silver, magnesium, tin, titanium, cobalt, or calcium [page 5, paragraph 24, lines 1-8; page 7, paragraph 34, lines 1-6], with a balance of the alloy being aluminum.

Independent claim 6 is similar to claim 1 but recites a narrower composition that includes approximately 14.0wt% to 15wt% of ytterbium as the first rare earth element and approximately 4.0wt% of yttrium as the at least one second rare earth element [page 5, paragraph 23, lines 1-3].

Independent claim 9 is also similar to claim 1 but recites a narrower composition that includes approximately 13.0wt% to 16.0% of gadolinium as the first rare earth element and

approximately 4.0wt% of yttrium as the at least one rare earth element [page 7, paragraph 33, lines 1-3].

Independent claim 10 is also similar to claim 1 but claims the aluminum alloy composition in the form of a gas turbine engine component [page 4, paragraph 21, lines 1-2; page 6-7, paragraph 30, lines 1-9; page 11, paragraph 45, lines 6-9].

Grounds of Rejection to be Reviewed on Appeal

I. Whether claims 1-4, 10-13, and 26-29 were properly rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent 6,248,453 to Watson (hereafter "Watson").

II. Whether claims 1-5, 7, 8, 10-16, and 27-29 were properly rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent 4,713,216 to Higashi, et al. (hereafter "Higashi").

III. Whether claims 1-3, 7-12, 15, 16, 26, and 27 were properly rejected under 35 U.S.C. §103(a) as being unpatentable over EP 750911 (hereafter "EP '911").

Arguments

I. Rejection of claims 1-4, 10-13 and 26-29 under 103(a) over Watson.

The Watson reference does not disclose an aluminum alloy composition that is identical to the claimed composition. However, the Examiner argues that Watson discloses the chemical elements of the claimed composition and that Watson suggests that certain chemical elements are equivalents that can be substituted for other chemical elements to achieve the claimed composition. Respectfully, Appellant disagrees because Watson does not seem to suggest that the chemical elements are equivalents as the Examiner argues.

In general, Watson discloses an aluminum alloy having dispersed particles for strength. The particles are a compound of aluminum and an alloying element, referred to in Watson as a $L1_2$ forming element. The Examiner asserts that Watson discloses a preferred composition having scandium as a $L1_2$ forming element. Watson also discloses other $L1_2$ forming elements, including erbium and ytterbium.

The Examiner asserts that scandium, erbium, and ytterbium are equivalent elements because Watson lists each of scandium, erbium, and ytterbium as $L1_2$ forming elements. The Examiner then concludes that it would be obvious to substitute both erbium and ytterbium for

scandium to achieve the claimed composition because scandium, erbium, and ytterbium are equivalent elements.

Respectfully, Appellant disagrees that scandium, erbium, and ytterbium are equivalent elements that can be substituted for each other without regard for other factors as the Examiner seems to suggest. That is, the atomic interactions of the composition of Watson appear to be somewhat more complex than the subject rejection appreciates. For instance, aluminum and scandium of the aluminum alloy of Watson are arranged in a 3-dimensional matrix known as a lattice structure. The lattice structure includes dimensions between atomic elements known as lattice parameters, such as distances between corners of a cubic lattice structure (see generally col.2, lines 12-31). The atomic elements of the particles in the aluminum alloy are also arranged in a lattice structure. According to Watson, there are drawbacks if the lattice parameters of the aluminum alloy matrix are too different from the lattice parameters of the particles (col.2, lines 12-34). Thus, Watson appears to teach aluminum-scandium alloy compositions having compatible amounts of the various chemical elements to avoid the given drawbacks.

The compositions of Watson overcome the given drawbacks by using a modifying element selected from magnesium, silver, zinc, copper, or lithium in the alloy to modify the lattice parameters of the aluminum-scandium matrix. For instance, Table I in Watson lists the changes in the lattice parameters of the matrix that are expected from the addition of each given element. Thus, there appears to be atomic interactions between the aluminum-scandium of the matrix and the modifying element that results in modification to the lattice parameter of the matrix.

The teachings of Watson do not appear to extend to compositions that do not include scandium. For example, the given problem and solution of Watson are presented with reference to an aluminum-scandium alloy (col.2, lines 12-38) and each of the additional specific example compositions in Watson includes scandium (col.4, lines 7-22). Therefore, Watson seems to suggest that the atomic interactions of the modifying elements would only be effective in aluminum alloys having scandium. Thus, even though scandium, erbium, and ytterbium are listed as $L1_2$ forming elements, one of ordinary skill in the art would not appear to expect that the modifying elements would be effective if scandium were replaced with erbium and ytterbium as the Examiner proposes because scandium seems to be necessary for atomically interacting with the modifying elements to achieve the modifying effect.

Therefore, Watson seems to teach that scandium is irreplaceable, and does not teach that erbium and ytterbium are equivalents that may be substituted for scandium as the Examiner suggests. For at least this reason, Appellant respectfully requests that the rejection be withdrawn.

II. Rejection of Claims 1-5, 7, 8, 10-16, and 27-29 under 35 U.S.C. §103(a) over Higashi.

The Examiner asserts that the composition of the Higashi reference having up to 10wt% of rare earth elements is close enough to the claimed composition of greater than 10wt% that one of ordinary skill in the art would have expected these ranges to have the same properties. The Examiner relies on *Titanium Metals Corp. of America v. Banner*, 778 F.2d 775, 227 USPQ 773 (Fed. Cir. 1985) to establish obviousness of close ranges.

Respectfully, Appellant disagrees with the Examiner's conclusion and reliance on *Titanium Metals Corp.* because Higashi teaches away from using an amount of rare earth elements that is greater than 10wt%. In *Titanium Metals*, there was no evidence establishing that the close ranges were not equivalent. In absence of such evidence, the court concluded that the ranges were equal. In contrast, Higashi provides evidence of non-equivalence by teaching away from using an amount of rare earth element that is greater than 10wt% (col. 2, lines 46-47). Thus, the *Titanium Metals Corp.* case should not be applied in the instant rejection to establish obviousness because there is evidence in Hagashi that the ranges are not equal. For this reason, Appellant respectfully requests that the rejection be withdrawn.

III. Rejection of Claims 1-3, 7-12, 15, 16, 26, and 27 under 103(a) over EP '911.

The Examiner argues that the claimed minor alloy elements are inherently included as impurities in the composition of EP '911. In further support, the Examiner points to "Aluminum and Aluminum Alloys," page 639, which lists various elements that are commonly found as impurities in aluminum alloys.

Respectfully, Appellant disagrees with the rejection because impurity elements should not be interpreted as being equivalent to the claimed elements. The claims recite "at least one minor alloy element" in the claimed composition. The term "alloy element" suggests that the presence of the element in the composition is intended. The term "alloy element" also suggests that the element is present in an amount suitable to contribute to the properties of the alloy. In contrast,

impurity elements are not intended to be present within the composition in any appreciable amount that affects the properties of the alloy. Indeed, manufacturers typically take measures to remove impurity elements. Therefore, an impurity element should not be interpreted as being equivalent to the claimed minor alloy element. By interpreting the claimed minor alloy element as an impurity element, the Examiner has effectively read this claim limitation out of the claim. Accordingly, Appellant respectfully requests that the rejection be withdrawn.

CLOSING

For the reasons set forth above, the final rejection of claims 1-16 and 26-29 is improper and must be reversed.

Respectfully Submitted,

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CERTIFICATE OF FACSIMILE

I hereby certify that this response is being facsimile transmitted to the United States Patent and Trademark Office, 571-273-8300 on January 22, 2008.

Laura Combs

CLAIMS APPENDIX

1. An aluminum alloy comprising:

approximately 1.0 to 20.0% by weight of a first rare earth element selected from the group consisting of ytterbium and gadolinium;

a plurality of insoluble particles formed of said first rare earth element;

approximately 0.1 to 10.0% by weight of at least one second rare earth element selected from the group consisting of gadolinium, erbium and yttrium if said first rare earth element is ytterbium or the group consisting of ytterbium, erbium and yttrium if said first rare earth element is gadolinium, wherein a combined weight of the first rare earth element and the at least one second rare earth element is greater than 10.0% by weight; and

at least one minor alloy element comprising copper, zinc, silver, magnesium, tin, titanium, cobalt or calcium, wherein a balance of the aluminum alloy is aluminum.

2. The aluminum alloy as recited in claim 1 further including approximately 1.0 to 15% total by weight of the at least one minor alloy element.

3. The aluminum alloy as recited in claim 1 wherein said at least one minor alloy element comprises magnesium.

4. The aluminum alloy as recited in claim 1 wherein said first rare earth element is ytterbium and said plurality of insoluble particles are formed of said ytterbium

5. The aluminum alloy as recited in claim 4 wherein said at least one second rare earth element is said yttrium.

6. An aluminum alloy comprising:

approximately 14.0% to 15% by weight of a first rare earth element consisting of ytterbium;

a plurality of insoluble particles formed of said first rare earth element; and

approximately 4.0% by weight of at least one second rare earth element consisting of yttrium, wherein a balance of the aluminum alloy is aluminum.

7. The aluminum alloy as recited in claim 1 wherein said first rare earth element is gadolinium and said plurality of insoluble particles are formed of said gadolinium

8. The aluminum alloy as recited in claim 7 wherein said at least one second rare earth element is said yttrium.

9. An aluminum alloy comprising:

approximately 13.0 to 16.0% by weight of at least one first rare earth element consisting of gadolinium;

a plurality of insoluble particles formed of said first rare earth element; and

approximately 4.0% by weight of at least one second rare earth element consisting of yttrium, wherein a balance of the aluminum alloy is aluminum.

10. A gas turbine engine component comprising:

components of an aluminum alloy including approximately 1.0 to 20.0% of a first rare earth element selected from the group consisting of gadolinium and ytterbium, a plurality of insoluble particles formed of said first rare earth element, approximately 0.1 to 10.0% by weight of at least one second rare earth element selected from the group consisting of gadolinium, erbium and yttrium if said first rare earth element is ytterbium or the group consisting of ytterbium, erbium and yttrium if said first rare earth element is gadolinium, and at least one minor alloy element comprising copper, zinc, silver, magnesium, tin, titanium, cobalt or calcium, wherein a combined weight of the first rare earth element and the at least one second rare earth element is greater than 10.0% by weight and a balance of the aluminum alloy is aluminum.

11. The gas turbine engine component as recited in claim 10 further including approximately 1.0 to 15% total by weight of at least one minor alloy element.

12. The gas turbine engine component as recited in claim 11 wherein said at least one minor alloy element is selected from the group consisting of copper, zinc, silver, magnesium, manganese, tin, titanium, cobalt and calcium.

13. The gas turbine engine component as recited in claim 10 wherein said first rare earth element is ytterbium and said plurality of insoluble particles are formed of said ytterbium

14. The gas turbine engine component as recited in claim 13 wherein said at least one second rare earth element is yttrium.

15. The gas turbine engine component as recited in claim 10 wherein said first rare earth element is gadolinium and said plurality of insoluble particles are formed of said gadolinium.

16. The gas turbine engine component as recited in claim 15 wherein said at least one second rare earth element is yttrium.

26. The aluminum alloy as recited in claim 1, wherein the combined weight of the first rare earth element and the at least one second rare earth element is greater than 11.0% by weight.

27. The aluminum alloy as recited in claim 1, consisting essentially of the first rare earth element, the at least one second rare earth element, the at least one minor alloy element, and the aluminum.

28. The aluminum alloy as recited in claim 1, comprising approximately 0.1% to 6% by individual weight of at least two of the minor elements.

29. The aluminum alloy as recited in claim 28, wherein a combined amount of the minor alloy elements is approximately 1% to 15% by weight.

EVIDENCE APPENDIX

None.

RELATED PROCEEDINGS APPENDIX

None.